

(19) World Intellectual Property  
Organization  
International Bureau



(43) International Publication Date  
15 January 2004 (15.01.2004)

PCT

(10) International Publication Number  
**WO 2004/005557 A1**

- (51) International Patent Classification<sup>7</sup>: **C22B 11/00**, 7/00, 3/06
- (21) International Application Number:  
PCT/US2003/021439
- (22) International Filing Date: 7 July 2003 (07.07.2003)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:  
02077760.3 8 July 2002 (08.07.2002) EP
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- (81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.
- (84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).
- Published:**  
— with international search report  
— with amended claims
- Date of publication of the amended claims:** 18 March 2004
- For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

(54) Title: METAL COMPOUND REMOVAL

(57) Abstract: The present invention relates to a process for separating at least one metal compound and/or a component thereof from a mixture, said process comprising contacting the said mixture with a heteropoly acid or heteropoly acid anion, thereby producing a precipitate comprising the heteropoly acid or heteropoly acid anion and the metal compound and/or a component thereof. The present invention further relates to a process for the purification of a mixture containing at least one metal compound, said process comprising contacting the said mixture with a heteropoly acid or heteropoly acid anion, thereby producing a precipitate that is substantially insoluble in the said reaction mixture and recovering the reaction mixture.



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**PCT/US03/21439**

**AMENDED CLAIMS**

[Received by the International Bureau on 19 December 2003 (19.12.03): original claims  
1 to 22 amended; new claim 23 added; (4 pages) ]

**AMENDED CLAIMS**

[Received by the International Bureau on 19 December 2003 (19.12.03): original claims 1 to 22 amended; new claim 23 added; (4 pages) ]

1. Process for separating at least one metal compound and/or a component thereof from a mixture, said process comprising contacting the said mixture with a heteropoly acid or heteropoly acid anion, the heteropoly acid or heteropoly acid anion being anchored to a support material, thereby producing a precipitate comprising the heteropoly acid or heteropoly acid anion and the metal compound and/or the component thereof.
2. Process for separating at least one metal compound and/or a component thereof from a mixture containing catalyst and/or catalyst remains from a homogeneously catalyzed reaction, said process comprising contacting the said mixture with a heteropoly acid or heteropoly acid anion, thereby producing a precipitate comprising the heteropoly acid or heteropoly acid anion and the metal compound and/or the component thereof.
3. Process according to claim 1 or 2, wherein
  - the mixture is purified from the at least one metal compound and/or a component thereof and wherein a purified mixture is recovered; and/or
  - the precipitate is recovered from the mixture and the at least one metal compound and/or one or more components thereof are recovered from the precipitate.
4. Process according to claim 2, wherein the heteropoly acid or heteropoly acid anion is anchored to a support material and wherein the metal compound and/or one or more components thereof is recovered from the support material.
5. Process according to any of the preceding claims, wherein the amount of heteropoly acid or heteropoly acid anion is at least 0.1 equivalent.

6. Process according to claim 5, wherein the amount of heteropoly acid or heteropoly acid anion is at least 1 equivalent.
7. Process according to any of the preceding claims, wherein the said metal compound and/or component thereof consists of at least one metal atom and/or at least one ligand, or at least one metal ion and/or at least one counter ion and/or at least one ligand.
8. Process according to any of the preceding claims, wherein the heteropoly acid or heteropoly acid anion has been attached to an insoluble support material.
9. Process according to claim 8, wherein the support material is selected from the group consisting of insoluble oxides, preferably selected from the group consisting of alumina, silica, zirconia, titania, zinc oxide, magnesium oxide and clay materials, active carbons, zeolites, and combinations thereof.
10. Process according to claim 9, wherein the support is alumina.
11. Process according to claim 8, wherein the support material is selected from the group consisting of organic supports, such as polymers, composites, oligomers and coated materials.
12. Process according to any of the preceding claims, wherein the heteropoly acid or heteropoly acid anion, is selected from the group of Keggin type heteropoly acids and anions.
13. Process according to any of the preceding claims, wherein the metal compound is based on at least one metal from the group consisting of Rh, Ru, Ir, Pd and Pt.
14. Process according to any of the claims 7-13, wherein at least one of the ligands is selected from the group consisting of organic and inorganic molecules with electron donating properties, preferably from the group consisting of molecules containing one or more unsaturated bonds and of molecules containing one or more heteroatoms, selected from the group consisting of P, S, N and O.

15. Process according to claim 14, wherein at least one of the ligands is selected from the group consisting of phosphines, nitrogen and/or oxygen containing ligands, cyclic dienes, cyclic trienes, CO and H<sub>2</sub>O.
16. Process according to any of the preceding claims, wherein the metal compound is derived from the group consisting of precursor complexes [Rh((R,R)-Me-DuPHOS)(COD)]BF<sub>4</sub> ((R,R)-Me-DuPHOS = (-)-1,2-bis((2R,5R)-2,5-dimethylphospholano)benzene), [Ru((R)-BINAP)Cl<sub>2</sub>]<sub>2</sub>.NEt<sub>3</sub> (R)-BINAP = (R)-(+)-2,2'-bis(diphenylphosphino)-1,1'-binaphthyl, Pd(OAc)<sub>2</sub>, Rh(CO)(H)(PPh<sub>3</sub>)<sub>3</sub>, NiNO<sub>3</sub>(H<sub>2</sub>O)<sub>6</sub>.
17. Process according to any of the claims 8-16, wherein the support material is situated in a fixed bed type conformation and the mixture is passed there through, whereby the metal compound is attached to the at least one heteropoly acid or heteropoly acid anion and removed from the said mixture.
18. Process according to claim 17, wherein the support material is present in a structured form.
19. Process according to claim 18, wherein the support material is selected from the group consisting of monoliths, star shaped materials and maze shaped materials.
20. Process according to any of the claims 17-19, wherein the heteropoly acid or a heteropoly acid anion, or the support modified therewith, is slurried in the said mixture and subsequently removed therefrom.
21. Process according to any of the preceding claims wherein the metal compound is a catalyst or a remains thereof.
22. Process according to any of the preceding claims, wherein the metal compound is in a homogeneous phase, preferably dissolved in a solvent or present in a colloidal phase.

23. Process for carrying out a catalysed chemical reaction, said process comprising reacting suitable reactants in a liquid phase in the presence of at least one homogeneous metal catalyst, contacting the resulting reaction mixture after completion of the reaction with a heteropoly acid or a heteropoly acid anion, thereby producing a precipitate that is substantially insoluble in the said reaction mixture or with a support material having attached to its surface a heteropoly acid or a heteropoly acid anion and separating the reaction mixture from the solid material.